



Photonics for hydrogen energy research

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Un progetto di:







Photonics for advancing hydrogen energy research

- Solar-to-Hydrogen Conversion:

Photonic technologies help in designing photocatalyst materials that efficiently absorb and utilize sunlight to drive chemical reactions

- Optical Sensing and Monitoring:

Detection and measurement of hydrogen concentrations and impurities. Detection of Hydrogen leaks.

- Photonic Materials for Catalysis:

Development of new photonic materials can enhance the performance of catalysts used in electrochemical processes for hydrogen production

- Advanced Characterization:

Photonics-based techniques, such as Raman and infrared spectroscopy, allow for the detailed characterization of materials and reactions involved in hydrogen production and use









Advanced spectroscopy for hydrogen

- Hydrogen Purity Analysis:

Assess hydrogen purity by detecting impurities that can affect fuel cell performance

- Monitoring Catalysts:

Understanding and improving catalysts used in hydrogen production processes

- In-situ Spectroscopy:

Real-time monitoring of chemical reactions and processes in hydrogen production and storage

- Solar Hydrogen Production:

Development of photocatalysts for solar-driven hydrogen production

- Safety and Leak Detection:

Rapid detection of hydrogen leaks





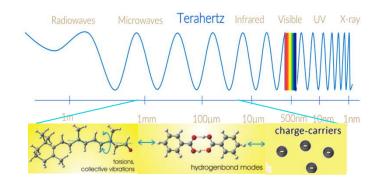
1. Advanced material characterization for green H₂ chain

THz spectroscopy for chemo-sensitive non-invasive material inspection:

inspection of materials for green H₂ chain and CO₂ capturing graphene from PET pyrolisis, perovskites, MOFs

biomass gasification gas sensing, syngas/sorbent interaction to maximise H_2 gas

purification efficiency investigation of THz assisted process for H₂ production











2. Raman analysis of gas mixture

- Full-optical technique giving the gas mixture composition: methane and other hydrocarbons, hydrogen, carbon dioxide, nitrogen
- From mixture composition, all the measurements required by the Italian law for natural gas diagnostics are obtained:
 - Calorific Power [kJ/m3], i.e., the amount of ENERGY in form of heat released by the combustion of a specific volume of the mixture
 - amount of carbon dioxide
 - amount of hydrogen (in view of possible hydrogen blending)
- Measurements defined by ISO 6976:2016 standard and OIML R 140 recommendation



